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10/566,270	01/30/2006	Tsutomu Fukuda	285291US0PCT	1695
22850 7590 07/19/2011 OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER LI, JIN				
ART UNIT		PAPER NUMBER		
1732				
NOTIFICATION DATE		DELIVERY MODE		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary**Application No.**

10/566,270

Applicant(s)

FUKUDA ET AL.

Examiner

JUN LI

Art Unit

1732

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 4-6 and 12-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4-6 and 12-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-940)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB-08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

1. Claim 1, 5-6, 12-16 and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ono (US4483940) in view of Buscaglia et al (Journal of Materials Science 1996, 31: 5009-5016) and Fukuda et al (JP 2002-145659).

Ono teaches a honeycomb carrier supporting a honeycomb catalyst for usage in internal combustion engines including treating exhaust gases (abstract, column 1 lines 24-26), wherein the honeycomb carrier can be any of the ceramic honeycomb carrier including aluminum titanate magnesia etc. (i.e. aluminum magnesium titanate) (column 8 lines 39-45).

Regarding claim 1 and 21-22, Ono fails to specifically teach the component of the honeycomb carrier is a sintered product containing Mg, Al, Ti containing compound with an empirical formula $Mg_xAl_{2(1-x)}Ti_{(1+x)}O_5$ ($0 \leq x \leq 1$) and with addition of alkali feldspar represented by $(Na_yK_{1-y})AlSi_3O_8$ (wherein $0 \leq y \leq 1$).

Buscaglia teaches decomposition of aluminum titanate imposed a serious limitation to its practical applicant (page 5009 left column last para.) and such decomposition can be controlled by addition of MgO wherein the presence of magnesium introduces a considerable delay before the decomposition starts (page

5010 left column 2nd para.) Buscaglia discloses after 240 h annealing at 1100 °C, solid solution of aluminum magnesium titanate with magnesium mol amount from $0.2 \leq x \leq 0.6$ showing only limited decomposition (7-15%). Buscaglia discloses there is no decomposition for $x=0.1$ when heating at 1000 and 1200 °C (page 5010 left column 2nd para). Buscaglia also indicates that long term stability of aluminum magnesium titanate are important for practical applications (page 5010 left column last 2 para.) and that when Mg's mol percentage is 0.6, there is no decomposition for aluminum magnesium titanate after 250 hr treatment at temperature from 900-1175 °C (page 5013 Table 1). Buscaglia also indicates that decomposition ratio is depending on Mg's mol percentage and the solid solution aluminum magnesium titanate's annealing temperature (page 5013 first para., Table 1). It would have been obvious for one of ordinary skill in the art to adopt a proper Mg amount and annealing temperature for providing a long term stable aluminum magnesium titanate as suggested by Buscaglia.

It would have been obvious to one ordinary skill in the art at the time of invention filed to adopt a magnesium stabilized aluminum titanate compound as shown by Buscaglia (page 5010 left column 2nd para., last 2 para.) to practice the honeycomb carrier of Ono because Ono needs a specific aluminum magnesium titanate without specific describing one while Buscaglia provides an aluminum magnesium titanate with improved long term thermal stability.

Fukuda teaches using 1-15 parts by weight of alkali feldspar $((Na_xK_{1-x})AlSi_3O_8, 0 \leq x \leq 1)$ to increase the mechanical strength and stability of aluminum titanate based sintered compact at 1400-1700 °C (abstract, machine translated detailed description

page 3 paragraph [0012]). Fukuda further teaches that adding the alkali feldspar can control the grain growth of the sintered compact (machine translated detailed description page 3 paragraph [0014]), achieve a high mechanical, high stability at high temperature (i.e. high thermal stability), low thermal expansion and a stabilizing crystal structure wherein the obtained product can be used stably at high temperature about 1600 °C hundreds of times (abstract, machine translated detailed description page 5 paragraph [0025]).

It would have been obvious to one ordinary skill in the art at the time of invention filed to adopt the alkali feldspar of Fukuda to improve the aluminum titanate product because addition of alkali feldspar can improve the mechanical strength, corrosion resistance, thermal stability of the aluminum titanate as shown by Fukuda. Furthermore, to one of ordinary skill in the art it would have been obvious to combine the known elements such as magnesium stabilizer as shown by Buscaglia and alkali feldspar as shown by Fukuda to improve the aluminum titanate for making a desired aluminum magnesium titanate as a honeycomb carrier support for intended uses including internal combustion engines such as automobiles for treating their exhaust gases and depriving them of air pollutants such as nitrogen oxides, carbon monoxides as indicated by Ono (column 1 lines 24-27) and Fukuda (machine translated detailed description page 5 paragraph [0025],[0026]) because magnesium can help improve thermal stability as suggested by Buscaglia and alkali feldspar can help improve mechanical strength, thermal stability as suggested by Fukuda and combining known elements for predictable results is well within the scope of one ordinary skill in the art.

Ono in view of Buscaglia and Fukuda is silent about the recited remaining ratio difference, however, Ono in view of Buscaglia and Fukuda already teaches a substantially similar composition with desired long term thermal stability, and thus similar property such as the recited remaining ratio difference in the instant claims is expected. Furthermore, both Buscaglia and Fukuda respectively teaches addition of magnesium and alkali feldspar can help increasing aluminum titanate long term thermal stability as discussed above, thus the recited difference of such ratio (thermal stability) between aluminum titanate and aluminum titanate magnesium in the instant claims are thus expected results associated with addition of such elements.

Regarding claims 5 and 6, Ono teaches honeycomb catalyst is extensively used in internal combustion engines such as of automobiles for treating their exhaust gases and depriving them of air pollutants such as carbon monoxide, hydrocarbons and nitrogen oxides (col. 1 lines 24-27) wherein the base metal can be alkali metals and alkaline earth metals, rare earth metal and noble metals (col. 5 lines 53-58). Ono also discloses using such catalyst (Example 16, column 13 lines 61-62, Example 18, column 14 line 44) to remove nitrogen oxides NO_x from combustion gas burned in a cylindrical combustion apparatus where an air-methane mixed gas containing 3% methane was introduced into and burned (column 17 lines 14-22). The corresponding catalyst activity for removing NO is shown in Table 6 (column 17-18).

Furthermore, the recited limitations in claim 6 do not render the claimed aluminum magnesium titanate patentable.

Regarding claim 12 -13 and 16, the recited y and weight range of the alkali feldspar and the recited temperature firing temperature discussed above overlaps with the prior arts, a prima facie case of obviousness exists (See § MPEP 2144.05 [R-5] I).

Regarding claim 14-15, Fukuda further teaches the raw mixture containing TiO_2 and Al_2O_3 and alkali feldspar can be grinded to suitable particle diameter, such as to about 1 μm or less. Fukuda also suggests that there is no particular need about the grade of grinding of a raw material ([0015], [0016]).

It would have been obvious for one of ordinary skill in the art at the time of invention filed to adopt such size of raw mixture for obtaining a desired product as suggested by Fukuda. Thus the recited size is just an obvious modification over the prior art. Furthermore, MPEP points out changes in sizes over prior art cannot make the invention patentable distinct (See § MPEP 2144.04 [R-6] IV).

Regarding claim 18 -20, Fukuda further teaches the sintered compact with addition of alkali feldspar has outstanding erosion proof and corrosion resistance [0025] last 5 lines). It is to be noted that similar composition and similar method of for making a recited honeycomb carrier composition as in the instant applications have been fully disclosed in the applied prior arts, thus similar corrosion resistance associated with addition of alkali feldspar is expected from prior arts' teachings.

2. Claim 4 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ono (US4483940) in view of Buscaglia et al (Journal of Materials Science 1996, 31: 5009-5016) and Fukuda et al (JP 2002-145659) as applied to 1, 5-6, 12-16, 18-22, and further in view of Noda (US2001/0056034).

Regarding claim 4, Ono in view of Buscaglia and Fukuda has been described as above.

Ono further teaches that the cell density of the honeycomb carrier is 300cells/square inch (equals to 46.15 cells/cm^2), reading to the recited limitation of cell density within $15\text{-}124\text{cells/cm}^2$. Ono also teaches that the thermal expansion of the aluminum titanate magnesium is less than $0.3 \times 10^{-6} \text{ K}^{-1}$, which overlaps with the thermal expansion coefficient of the instant claim. MPEP clearly states that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. See MPEP §2144.05 [R5]. It is also noted that the thermal expansion coefficient is a determined physical property with a compound from chosen materials. Since the honeycomb carrier material is an obvious modification over prior art, thus the associated thermal expansion coefficient is also expected.

Ono in view of Buscaglia and Fukuda fails to expressly teach that the honeycomb carrier has a wall thickness from 0.05-0.6mm, and the porosity of the partition wall is 20-50%.

Noda teaches that the honeycomb carrier made from aluminum titanate with addition of Mg can have a porosity of 5-50%, preferably 10-40% (page 2 paragraph [0014]), which reads onto the recited limitation of porosity of 20-50% in the instant claim 4. Noda indicates that probably porosity is needed to maintain probable honeycomb carrier strength and suppresses the diffusion of alkali metal or alkaline earth metal catalyst into the carrier ((page 2 paragraph [0014])). Noda further teaches that a wall thickness of 0.05-0.1mm with a cell density $62\text{-}139.5 \text{ cells/cm}^2$ (page 2 paragraph

[0023]), reading into the recited limitation of the partition wall thickness of 0.05-0.6mm and cell density 15-124 cells/cm² in the instant claims. Noda also indicates that probable porosity and cell density can ensure good cell structure of honeycomb carrier with good bending strength and thermal expansion coefficient (less than $3.0 \times 10^{-6} \text{ K}^{-1}$) for effectively purifying NO_x from exhaust gas (page 3 table 1, paragraph [0028]).

It would have been obvious to one ordinary skill in the art at the time of the invention filed to adopt the porosity and cell density of Noda to improve the honeycomb carrier structure of the combined references. One ordinary skill in the art would have been motivated to do so because probable porosity and cell density can ensure good cell structure of honeycomb carrier with good bending strength and thermal expansion coefficient to effectively purify NO_x from exhaust gas (page 3 table 1, paragraph [0028]) and probable porosity can well suppresses alkali metal or alkaline earth metal catalyst into the carrier to ensure the durability of the catalyst (page 2 paragraph [0014] and page 3 paragraph [0029] lines 5-12).

Regarding claim 17, Ono in view of Buscaglia and Fukuda fails to expressly teach the catalyst comprising potassium.

Ono further teaches alkali metals can be used as honeycomb carrier supported catalyst component (column 5 lines 53-58) and Noda further teaches alkali metals including K can be used as catalyst (page 1 [0004]).

One of ordinary will have been obvious to use potassium as the catalyst component for purifying exhaust gas as shown by Noda because potassium is one of well known alkali metal catalyst component used in the art as shown by Noda and

adopting known technique for improving efficiency of similar method/product is well within the scope of one ordinary skill in the art.

Response to Arguments

Applicant's arguments filed 05/02/2011 have been fully considered but they are not persuasive. In response to applicant's arguments about Buscaglia directed to a long term thermal stability needed be heat treated at more than 250 hours, it is noted the instant claims directed to thermal treatment at 1100 °C for 100 hours or at 1000 °C for 80-100 hour. Buscaglia teaches decomposition of aluminum titanate imposed a serious limitation to its practical applicant (page 5009 left column last para.) and such decomposition can be controlled by addition of MgO wherein the presence of magnesium introduces a considerable delay before the decomposition starts (page 5010 left column 2nd para.) Buscaglia expressly teaches after 240 h annealing at 1100 °C, solid solution of aluminum magnesium titanate with magnesium mol amount from $0.2 \leq x \leq 0.6$ showing only limited decomposition (7-15%). Buscaglia discloses there is no decomposition for $x=0.1$ when heating at 1000 and 1200 °C (page 5010 left column 2nd para, Table 1 with $x=0.2$ at 1100 °C heating only 8% decomposition). Buscaglia also indicates that decomposition ratio is depending on Mg's mol percentage and the solid solution aluminum magnesium titanate's annealing temperature (page 5013 first para., Table 1). It would have been obvious for one of ordinary skill in the art to adopt a

proper Mg amount and annealing temperature for providing a long term stable aluminum magnesium titanate as suggested by Buscaglia.

In response to applicant's arguments about 09/13/2010 filed 1.132 affidavit provided unexpected/superior results, it is noted that such affidavit contains error, specifically, Section (2) thermal Decomposition Resistance Test on page 2 of the affidavit described heating at 1000 °C while Fig A and page 3 second line of this affidavit requires heating at 1100 °C, thus it is unclear what temperature of the actual heating has been performed, therefore renders the affidavit ineffective.

Assuming all the data been performed at 1100 °C as shown on the Fig. A is correct heating temperature, however, the heating time is for 500 hour, while the claims directed to heating at 100 hour, thus the supplied data is not in commensurate with the scope of claims. In addition, the claimed magnesium aluminum titanate is recited as a product by process limitations, it is noted that even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (See § MPEP 2133 [R-1], In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966, Fed. Cir. 1985). The supplied magnesium aluminum titanate only being fired at temperature 1400 °C for making such titanate, while instant claims directed to firing from 1000-1700 °C, the unexpected results are the result of unexpectedly improved results or a property not taught by the prior art, the

"objective evidence of nonobviousness must be commensurate in scope with the claims which the evidence is offered to support." In other words, the showing of unexpected results must be reviewed to see if the results occur over the entire claimed range (see §MPEP 716.02(d) [R-2]).

Furthermore, the supplied data in Fig. A only showing the effect of presence of alkali feldspar when x not greater than 0.5, i.e., with presence of alkali feldspar in magnesium aluminum titanate, its thermal stability improved as compared to magnesium aluminum titanate. While it is noted that such thermal stability is expected from Fukuda's teachings because Fukuda teaches that adding the alkali feldspar can control the grain growth of the sintered compact (machine translated detailed description page 3 paragraph [0014]), achieve a high mechanical, high stability at high temperature (i.e. high thermal stability), low thermal expansion and a stabilizing crystal structure wherein the obtained product can be used stably at high temperature about 1600 °C hundreds of times (abstract, machine translated detailed description page 5 paragraph [0025]).

Therefore, the claimed subject matter is not patentable distinct over the applied references.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JUN LI whose telephone number is (571)270-5858. The examiner can normally be reached on Monday-Friday, 9:00am-5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JUN LI/
Examiner, Art Unit 1732
07/05/2011

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1732